

MATH 126 Midterm Exam 1

Tuesday October 24, 50 minutes during your quiz section

Name:

Quiz section:

7-digit UW ID:

Exam Instruction:

- **You have 50 minutes to complete the exam. The exam contains 4 multi-part questions. Distribute your time accordingly.**
- Show your work to earn full credit. If you can not completely solve a problem, providing reasonable work and steps may still earn you some partial credit.
- The last page is a scratch paper, tear it off and do NOT turn it in unless you have written down additional work on it to be graded.
- **Do NOT write within 1 cm of the edge!** Your exam will be scanned for grading. If you run out of space, specify “see scratch paper”, then write you additional work on the scratch paper and turn it in together with your exam.
- You can bring one hand-written double-sided 8.5” × 11” page of notes.
- The only allowed calculator is TI-30X IIS.
- Cell phone must be turned off and put away for the duration of the exam.

- **You must finish the exam independently. Giving or receiving any assistance on the exam is considered cheating, which will result in a grade of zero for the exam.**

- **Do NOT discuss the exam questions in person or online after your exam.**

1. (10 pts) Part (a), (b) are independent. Show your work to earn partial credit.

(a) Find parametric equations of a line that is contained in the plane $2x + y + 3z = 5$, and is perpendicular to and intersects the line $x = 1, y = 2$. The answer may not be unique.

(b) Find the area of the triangle with vertices $A(1, 0, 1), B(1, 3, 2), C(0, 1, 2)$.

2. (10 pts) Part (a), (b) are independent. The answer is not unique. Show your work.

- (a) Give an example of two **non-parallel** vectors \mathbf{v} and \mathbf{w} such that $\text{proj}_{\mathbf{v}}\mathbf{w} = \langle 2, 1, 2 \rangle$ and $\text{comp}_{\mathbf{v}}\mathbf{w} = -3$.

$\mathbf{v} = \underline{\hspace{2cm}}$ $\mathbf{w} = \underline{\hspace{2cm}}$

- (b) Give an example of two distinct planes that intersect along the line $x = 1 + 2t$, $y = 1 - t$, $z = 3 + t$.

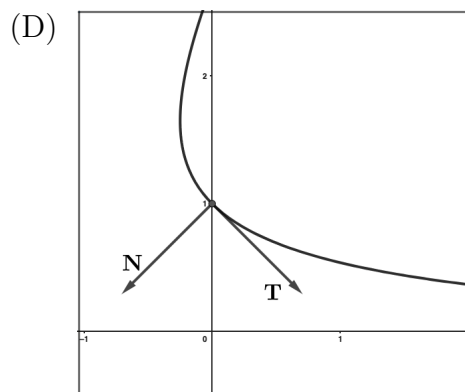
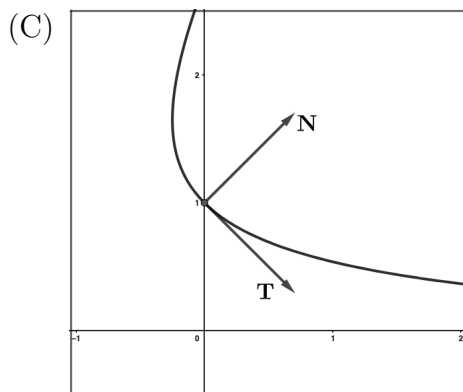
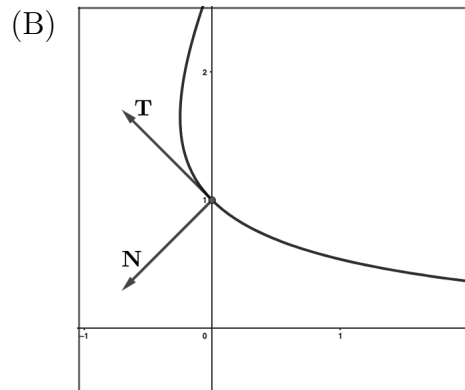
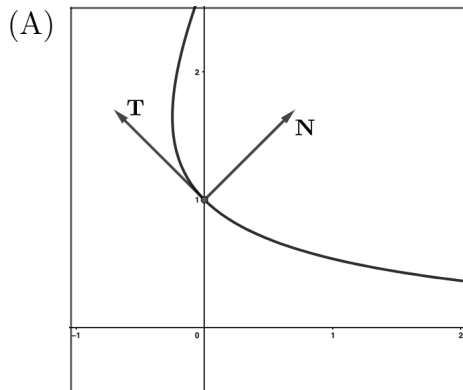
plane 1: $\underline{\hspace{2cm}}$

plane 2: $\underline{\hspace{2cm}}$

3. (11 pts) A space curve is given by the vector function $\mathbf{r}(t) = \langle 2t \sin t, t^2 + 2, t \cos t \rangle$.
- (a) Find the equation of a quadric surface that contains the curve. Identify which type of quadric surface is it.
- (b) What is the trace (cross section) curve of the surface you found in (a) on the plane $z = 1$? Circle your choice from the following:
- (A) parabola (B) circle (C) ellipse (D) hyperbola (E) line(s)
- (c) Find the angle of intersection between the curve $\mathbf{r}(t)$ and the line $x = y - 2 = 3z$ at the intersection point $(0, 2, 0)$. Leave your answer as an exact expression.

4. (11 pts) A particle moves along a curve in \mathbb{R}^2 with position vector function $\mathbf{r}(t) = \langle t^2 - t, e^t \rangle$.

(a) Which graph illustrates the unit tangent vector and the unit normal vector at $t = 0$? Circle your choice from (A)(B)(C)(D).



(b) On the graph you chose above, sketch the acceleration vector $\mathbf{a}(t)$ at $t = 0$.

(c) Is the tangential component of the acceleration at $t = 0$ positive or negative? No need to explain your answer.

(d) Compute the curvature of the curve at $t = 0$.

scratch paper

scratch paper